

# Notes - Transformations of Functions

$a f(b(x-c)) + d$  → shift <sup>+</sup> up and down <sup>-</sup>

negative = reflect over x-axis  
 vertical stretch/shrink  
 $|a| > 1$  = stretch  
 $0 < |a| < 1$  = shrink

negative = reflect over y-axis  
 horizontal stretch/shrink  
 $|b| > 1$  = shrink compression  
 $0 < |b| < 1$  = stretch

shift left and right  
 $(x-c)$  = right  
 $(x+c)$  = left

Linear:  $y = a(b(x-c)) + d$  Ex:  $y = -2x + 5$   $a = -2$   $b = 1$   
 ~~$c = 0$~~   $d = 5$

Absolute value:  $y = a|b(x-c)| + d$  Ex:  $y = 1|3x| + 2$   $a = 1$   $b = 3$   
 ~~$c = 0$~~   $d = 2$

Quadratic:  $y = a(b(x-c))^2 + d$  Ex:  $y = 5(x-1)^2 + 6$   $a = 5$   $b = 1$   
 $c = 1$   $d = 6$

Square Root:  $y = a\sqrt{b(x-c)} + d$  Ex:  $y = \frac{1}{2}\sqrt{-x} - 1$   $a = \frac{1}{2}$   $b = -1$   
 ~~$c = 0$~~   $d = -1$

Cubic:  $y = a(b(x-c))^3 + d$  Ex:  $y = 1(2(x+3))^3 + 4$   $a = 1$   $b = 2$   
 $c = -3$   $d = 4$

Inverse:  $y = \frac{a}{b(x-c)} + d$  Ex:  $y = \frac{1}{2(x-3)}$   $a = 1$   $b = 2$   
 $c = 3$   $d = 0$

Exponential:  $y = ae^{b(x-c)} + d$  Ex:  $y = 1e^{x-2} - 1$   $a = 1$   $b = 1$   
 $c = 2$   $d = -1$

Logarithmic:  $y = a\ln(b(x-c)) + d$  Ex:  $y = -2\ln(x+1)$   
 $a = -2$   ~~$b = 1$~~   $c = -1$   ~~$d = 0$~~

Sine:  $y = a\sin(b(x-c)) + d$  Ex:  $y = 4\sin(\frac{1}{2}x) + 3$   
 $a = 4$   $b = \frac{1}{2}$   ~~$c = 0$~~   $d = 3$